HR-351 Bentonite Treatment for Economical Dust Control on Limestone Surfaced secondary Roads

Key Words: Dust Control, Bentonite, Aggregate Surfaced Roads

ABSTRACT

This research project was directed at laboratory and field evaluation of sodium montmorillonite clay (Bentonite) as a dust palliative for limestone surfaced secondary roads. It was postulated that the electrically charged surfaces (negative) of the clay particles could interact with the charged surfaces (positive) of the limestone and act as a bonding agent to agglomerate fine #200) particulates, and also to bond the fine particulates to larger (+ #200) limestone particles.

One mile test roads were constructed in Tama, Appanoose, and Hancock counties in Iowa using Bentonite treatment levels (by weight of aggregate) ranging from 3.0 to 12.0 percent. Construction was accomplished by adding dry Bentonite to the surfacing material and then dry road mixing. The soda ash/water solution (dispersing agent) was spray applied and the treated surfacing material wet mixed by motor graders to a consistency of 2 to 3 inch slump concrete. Two motor graders working in tandem provided rapid mixing. Following wet mixing the material was surface spread and compacted by local traffic.

Quantitative and qualitative periodic evaluations and testing of the test roads was conducted with respect to dust generation, crust development, roughness, and braking characteristics. As the Bentonite treatment level increased dust generation decreased. From a cost/benefit standpoint, an optimum level of treatment is about 8 percent (by weight of aggregate). For roads with light traffic, one application at this treatment level resulted in a 60-70 percent average dust reduction in the first season, 40-50 percent in the second season, and 20-30 percent in the third season. Crust development was rated at two times better than untreated control sections. No discernible trend was evident with respect to roughness. There was no evident difference in any of the test sections with respect to braking distance and braking handling characteristics, under wet surface conditions compared to the control sections.

Chloride treatments are more effective in dust reduction in the short term (3-4 months). Bentonite treatment is capable of dust reduction over the long term (2-3 seasons). Normal maintenance blading operations can be used on Bentonite treated areas.

Soda ash dispersed Bentonite treatment is conservatively estimated to be more than twice as cost effective per percent dust reduction than conventional chloride treatments, with respect to time. However, the disadvantage is that there is not the initial dramatic reduction in dust generation as with the chloride treatment. Although dust is reduced significantly after treatment there is still dust being generated. Video evidence indicates that the dust cloud in the Bentonite treated sections does not rise as high, or spread as wide as the cloud in the untreated section. It also settles faster than the cloud in the untreated section. This is considered important for driving safety of following traffic, and for nuisance dust invasion of residences and residential areas.

The Bentonite appears to be functioning as a bonding agent to bind small limestone particulates to larger particles and is acting to agglomerate fine particles of limestone as evidenced by laboratory sieve analysis data, and by SEM micrographs. This bonding capability appears recoverable from environmental effects of winter, and from alternating wet and dry periods. The Bentonite is able to interact with new applications of limestone maintenance material and maintains a dust reduction capability.